The time-dependent structure of the electron reconnection layer

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Collisionless magnetic reconnection is often associated with time-dependent behavior. Specifically, current layers in the diffusion region can become unstable to tearing-type instabilities on one hand, or to instabilities with current-aligned wave vectors on the other. In the former case, the growth of tearing instabilities typically leads to the production of magnetic islands, which potentially provide feedback on the reconnection process itself, as well as on the rate of reconnection. The second class on instabilities tend to modulate the current layer along the direction of the current flow, for instance generating kink-type perturbations, or smaller-scale turbulence with the potential to broaden the current layer. All of these processes contribute to rendering magnetic reconnection time-dependent. In this presentation, we will provide a summary of these effects, and a discussion of how much they contribute to the overall magnetic reconnection rate.